

DuPont™ Vespel® SCP Family of Polymers

NOW AVAILABLE IN SHAPES



Vespel® SCP grades provide the next level of performance and more options for your most demanding applications.

The DuPont™ Vespel® SCP family of products deliver improved part life, reduced weight and costs. These benefits are delivered through increased temperature handling, greater strength, improved dimensional stability, broader chemical compatibility and greatly improved wear resistance. Whether you are machining parts from rods or bars, Vespel® SCP shapes provide yet more options to deliver superior performance. DuPont™ Vespel® is committed to delivering Big Science, part by part, faster than ever before.

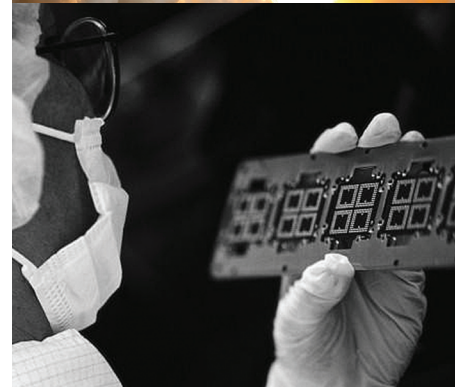
More Ways to Improve Performance

SCP-5000 is an unfilled polymer providing enhanced strength and dimensional stability.

SCP-5050 and SCP-50094 employ new filler technologies for lower friction and enhanced wear resistance.

Authentic Vespel® Shapes Offer:

- Quick and easy global product availability
- Alternative to direct formed parts
- Dimensional flexibility
- Product consistency
- Quality certification
- Fast prototyping
- Improved economies of scale for lower volume custom parts



**Vespel® SCP Family built on
proven experience of delivering
solutions to industries that
demand results.**

**For technical support,
material samples, or
a machining guide, call
1-800-222-VESP (8377)
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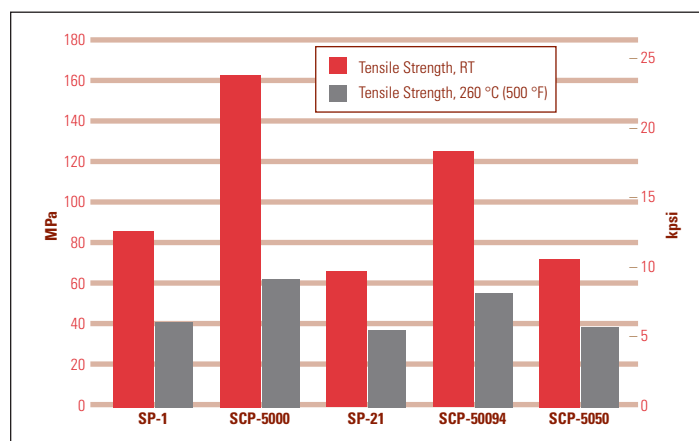
Typical Properties — DuPont™ Vespel® Isostatic Shape Grades

	ASTM Method	Units	Vespel® SP					Vespel® SCP		
			SP-1 Unfilled	SP-21 15% graphite	SP-22 40% graphite	SP-211 15% graphite & 10% Teflon®	SP-3 Vacuum Bearing Grade	SCP-5000 Unfilled	SCP-50094 Graphite Bearing Grade—Low Fill	SCP-5050 Graphite Bearing Grade—High Fill
Mechanical										
Tensile Strength, 23 °C (73 °F)	D1708/D638	MPa (kpsi)	86.2 (12.5)	65.5 (9.5)	51.7 (7.5)	44.8 (6.5)	56.5 (8.2)	163 (23.6)	124 (18.0)	72 (10.5)
Tensile Strength, 260 °C (500 °F)	D1708/D638	MPa (kpsi)	41.4 (6.0)	37.9 (5.5)	23.4 (3.4)	24.1 (3.5)		62 (9)	55 (8.0)	39 (5.6)
Elongation at Break, 23 °C (73 °F)	D1708/D638	%	7.5	4.5	3.0	3.5	4.0	7.5	4.3	2.5
Elongation at Break, 260 °C (500 °F)	D1708/D638	%	6.0	3.0	2.0	3.0		49.0	13.0	5.3
Flexural Modulus, 23 °C (73 °F)	D790	MPa (kpsi)	3100 (450)	3790 (550)	4830 (700)	3100 (450)	3280 (475)	5760 (836)	6360 (923)	7790 (1,130)
Flexural Modulus, 260 °C (500 °F)	D790	MPa (kpsi)	1720 (250)	2550 (370)	2760 (400)	1380 (200)	1860 (270)	3010 (436)	3540 (514)	5100 (740)
Compressive Stress at 10% strain, 23 °C (73 °F)	D695	MPa (kpsi)	133 (19.3)	133 (19.3)	112 (16.3)	102 (14.8)	128 (18.5)	230 (33.4)	220 (31.9)	172 (25)
Deformation Under 13.8 MPa (2,000 psi) load	D621	%	0.14	0.10	0.08	0.13	0.12	0.05	0.05	0.03
Friction										
Coeff. of Friction at PV = .875 MPa m/s (25,000 psi-ft/min)*			0.29	0.24	0.20	0.12	0.25	0.26	0.25	0.12
Coeff. of Friction at PV = 3.5 MPa m/s (100,000 psi-ft/min)*				0.12	0.09	0.08	0.17	0.15	0.07	0.08
Static Coeff. of Friction in Air*			0.35	0.30	0.27	0.20				
PV Limit (unlubricated)**		MPa-m/s (kpsi ft/min)		12.3 (350)	12.3 (350)	3.5 (100)			17.5 (500)	
Other Properties										
Coeff. of Thermal Expansion, 23–300 °C (73–572 °F)	E831	µm/m/K (10 ⁻⁶ in/in-°F)	54 (30)	49 (27)	38 (21)	54 (30)	52 (29)	47 (26)	43 (24)	29 (16)
Hardness	D785	Rockwell E	45–60	25–45	5–25	1–20	40–55	95	91	63
Water Absorption, 24 hr at 23 °C (73 °F)	D570	%	0.24	0.19	0.14	0.21	0.23	0.08	0.06	0.04

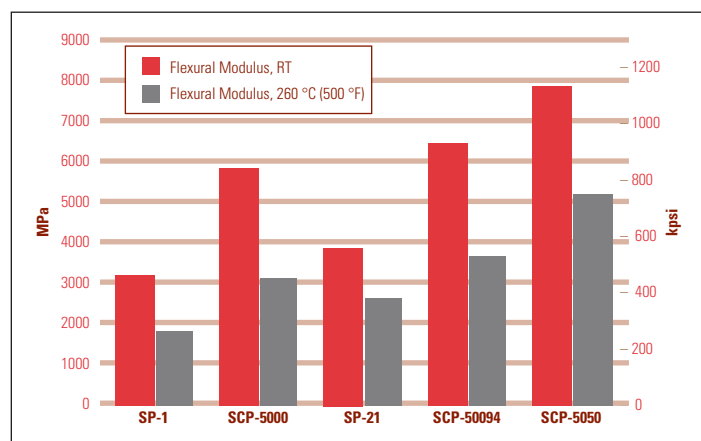
* Versus carbon steel, steady state, unlubricated, in air, thrust bearing.

** PV limits for any material vary with different combinations of pressure and velocity as well as other conditions.

Tensile Strength



Flexural Modulus



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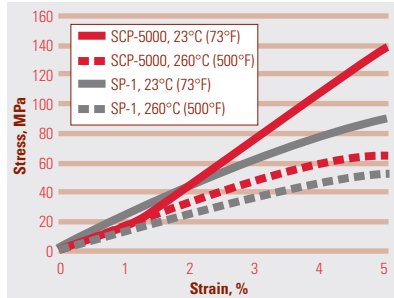
DuPont™ Vespel® SCP-5000 Parts Make Great Seals, Insulators and More for Hotter Environments

With even better temperature resistance, chemical compatibility and dimensional stability than traditional polyimides, new Vespel® SCP-5000 parts can extend part life and cut cost and weight in replacing metal and other materials in aerospace, semiconductor and other industrial applications.



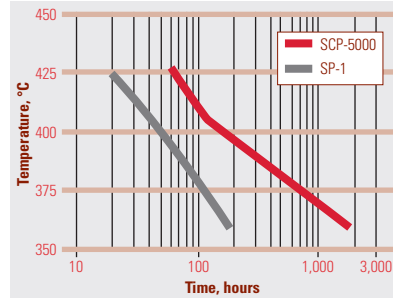
Stronger

Fig. 1: Compression stress/strain



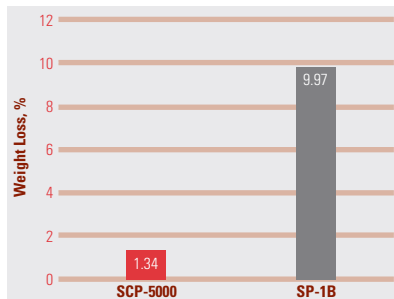
Stays stronger

Fig. 2: Time of retention of ≥50% of original tensile strength



Better heat stability

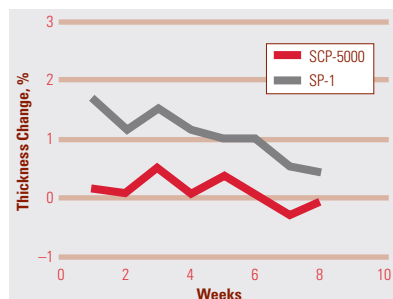
Fig. 3: Thermal oxidative stability, 100 hours at 371°C (700°F), 4.76 atm (70 psia)



Test specimen: 1/2 tensile bar

More dimensional stability

Fig. 4: Thickness change/time after exposure to 38°C (100°F), 90% RH



Note: Properties shown in all charts are based on isostatically molded shapes.

Introducing hotter-running Vespel®

One of the latest DuPont advances in material science, the Vespel® SCP family uses a new polyimide that extends the application range of polyimide parts and shapes into even higher temperature environments. This document focuses on Vespel® SCP-5000, an unfilled grade.

Lighter, less costly seals

In applications such as seals and valve seats needing enhanced high-temperature performance, Vespel® SCP-5000 parts can save weight, reduce actuation force required and cut fabrication costs in replacing metal-to-metal seals. They can also extend part life in replacing plastics with lower thermal capabilities.

Long life in hot environments

In thermal oxidative testing in a pressurized, oxygen-rich environment at very high temperature (Figure 3), Vespel® SCP-5000 specimens exhibited 87% less weight loss than a traditional polyimide.

Figure 2 shows how well Vespel® SCP-5000 parts retain strength from 370 to 430°C in air. At 370°C, for example, they retain half of their original tensile strength more than 5 times longer than traditional polyimide. In inert environments such as nitrogen or vacuum, Vespel® SCP-5000 parts can perform at temperatures up to at least 340°C with only negligible loss of mechanical properties.

Stronger over a broader temperature range

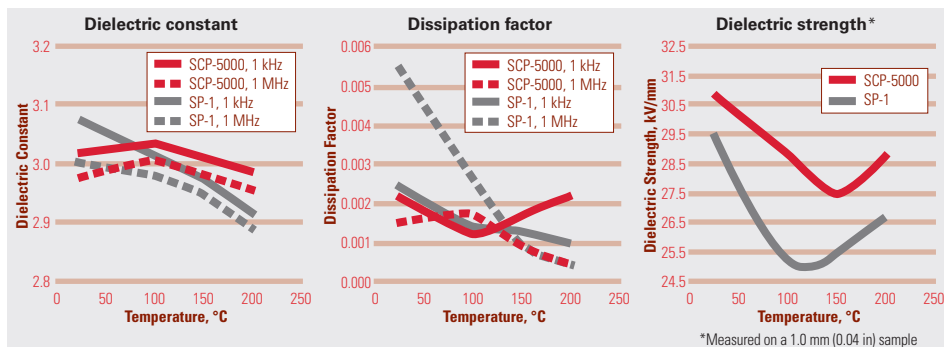
For initial strength and stiffness and in retention of strength and stiffness in high-temperature environments, Vespel® SCP-5000 parts outperform traditional polyimides. As shown in Figure 1, their compression strength at 5% strain is about 60% higher than traditional polyimide at ambient temperature and 30% higher at 260°C.

continued



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DuPont™ Vespel® SCP-5000 parts make higher performance insulators



Note: Properties shown in all charts are based on isostatically molded shapes.

Better insulators can work hotter

Vespel® SCP-5000 parts have outstanding dielectric properties over wide temperature and frequency ranges as shown in the charts above. Their dielectrics, in combination with high strength and excellent thermal properties, show that Vespel® SCP-5000 parts can perform very well as insulators and other electrical components in severe environments.

Improved dimensional stability

Vespel® SCP-5000 parts outperform traditional polyimide with substantially less dimensional change resulting from moisture uptake (Figure 4 on p. 1).

Chemical resistance

Vespel® SCP-5000 parts surpass the already excellent solvent resistance of traditional polyimides. They are compatible with most chemicals, but

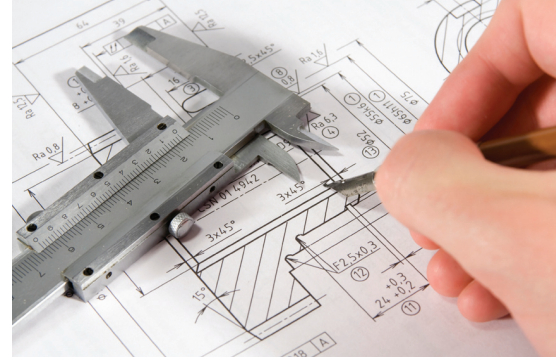
we recommend verifying compatibility with specific chemicals. Please contact the nearest location for DuPont™ Vespel®.

Need more wear resistance?

The Vespel® SCP family also includes two compositions with new filler technologies, Vespel® SCP-5050 and SCP-50094. They have enhanced friction and wear properties and a lower coefficient of thermal expansion in addition to higher-temperature performance. To learn more, please visit <http://dupont.vespel.com> or contact the nearest DuPont location.

Let's talk

We have the right materials, technology and technical resources to help you design and manufacture superior parts and systems. Please contact the nearest DuPont representative for your country.



Our application specialists stand ready to assist you in designing your part.

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DuPont™ Vespel®

VESPEL® SHAPES OFFER A WIDE RANGE OF MATERIAL SOLUTIONS FOR YOUR MOST AGGRESSIVE ENVIRONMENTS



Vespel® shapes provide outstanding design flexibility combined with a unique combination of the physical properties common among engineered plastics, metals and ceramics.

Vespel® shapes offer:

- Proven successful performance in applications from cryogenic to 349 °C (660 °F), with excursions to 482 °C (900 °F)
- Low wear and friction at high pressures and velocities (lubricated or unlubricated)
- Outstanding creep resistance
- Strength and impact resistance
- Exceptional chemical resistance
- Excellent machinability

Specify the best DuPont™ Vespel® product to meet your application requirements

SP-1 for physical and electrical properties

- superior wear, maximum strength and elongation
- minimal electrical and thermal conductivity
- low outgassing with high purity

SP-3 for unlubricated sealing and low wear in vacuum or dry environments

- maximum wear and friction resistance
- ultra-low outgassing

SP-21 for balanced low wear and physical properties

- low-friction properties work with or without lubrication
- long elongation and high stiffness

SP-211 for low coefficient of friction and unlubricated wear

- lower coefficient of friction even without lubrication than SP-21
- excellent creep resistance

SP-22 for low wear and dimensional stability

- enhanced resistance to wear and friction
- minimal thermal expansion
- oxidative stability

SP-202 for electrical conductivity with low wear rates

- electrostatic charge removal
- maintains tolerances in high heat and through multiple cycles

SCP-5000 for strength, hardness and chemical resistance over broad temperature range

- high wear resistance with low outgassing and high purity
- thermal oxidative stability

SCP-5009 for higher temperature and better compressive strength

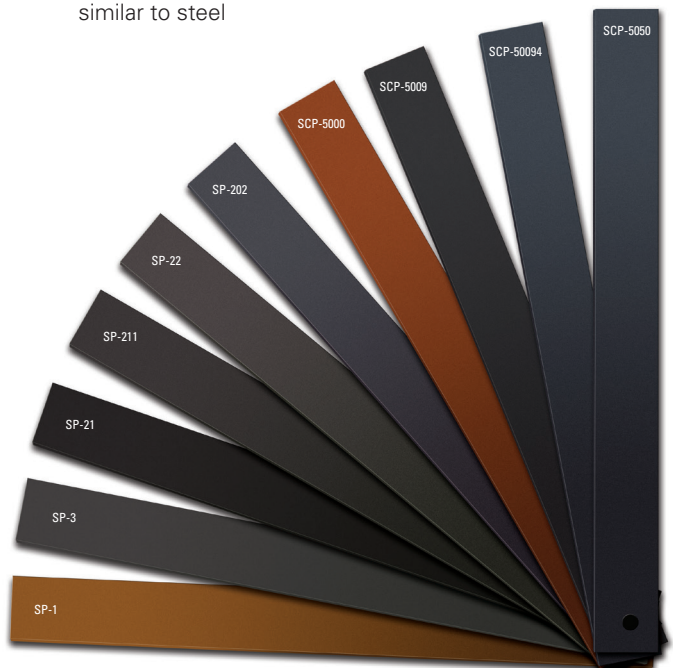
- lower coefficient of friction without lubrication
- excellent sealing capability

SCP-50094 for high temperatures and wear resistance

- superior wear
- thermal oxidative stability

SCP-5050 for high temperatures, wear resistance and exceptional coefficient of friction

- improved high temperature and wear resistance
- coefficient of thermal expansion similar to steel



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For over 40 years, DuPont™ Vespel® parts and shapes have delivered innovative solutions for demanding applications.

Authentic DuPont™ Vespel® shapes are a combination of material composition, geometric size/shape and process method. They are manufactured only by DuPont and sold only through Authorized Distributors of DuPont™ Vespel®.

We do not guarantee availability of the specified shapes in all the stated sizes below. For example, an OD range of 165–470 mm (6.5–18.5 in) does not imply that any OD within this range is available for sale. Contact an Authorized Distributor if you require any of the sizes below or if you have other size requirements.

Vespel® shapes are available in a wide variety of sizes.

[illegible]

Shape	Resins	Size Range
Disk	SP-1 and SCP-5000	OD: 165–470 mm (6.5–18.5 in) Thickness: 22–59.8 mm (0.87–2.35 in)
Ring	SP-1, SP-21 and SCP-5000	OD: 125–545 mm (4.92–21.46 in) ID: 55.9–419.1 mm (2.2–16.5 in) Thickness: 1.2–52 mm (0.05–2.05 in)
Plaque	SP-1, SP-21, SP-22, SP-211, SP-3 and SP-202	Max Size: 254 x 254 mm (10 x 10 in) Thickness: 1.6–50.8 mm (0.06–2.0 in)
Bar	SP-1, SP-21, SP-22, SP-211, SP-3, SCP-5000, SCP-5009, SCP-50094 and SCP-5050	Thickness x Width: 50.8 x 101.0 mm (2 x 4 in) and 38.1 x 88.9 mm (1.5 x 3.5 in) Max Length: 965 mm (38 in)
Rod	SP-1, SP-21, SP-22, SP-211, SP-3, SCP-5000, SCP-5009, SCP-50094 and SCP-5050	D: 3.1–82.5 mm (0.125 – 3.25 in) in standard increments of 3.1 mm (0.125 in) Max Length: 965 mm (38 in)
Tube	SP-1, SP-21, SP-22, SP-211 and SP-3	OD: 40.6–317 mm (1.6–12.5 in) Nominal Wall: 3.0–50.8 mm (0.12–2.0 in) Max Length: 838 mm (33 in)
Ball	SP-1	D: 3.175 – 15.875 mm (0.125 – 0.625 in)

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